

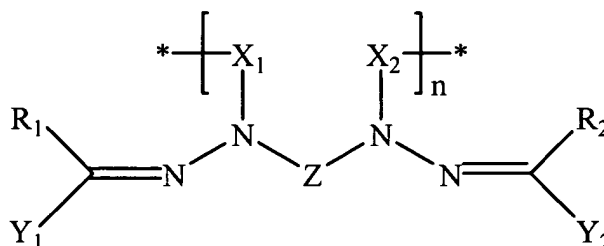
## CLAIMS

What is claimed is:

1. An organophotoreceptor comprising an electrically conductive substrate and a photoconductive element on the electrically conductive substrate, the photoconductive element

5 comprising:

(a) a charge transport composition having the formula



where Y<sub>1</sub> and Y<sub>2</sub> are, each independently, an arylamine group;

$X_1$  and  $X_2$  are, each independently, a linking group;

10 R<sub>1</sub> and R<sub>2</sub> are, each independently, a hydrogen, an alkyl group, an alkenyl group, a heterocyclic group, an aromatic group;

Z is a bridging group; and

n is a distribution of integers between 1 and 100,000 with an average value greater than

1; and

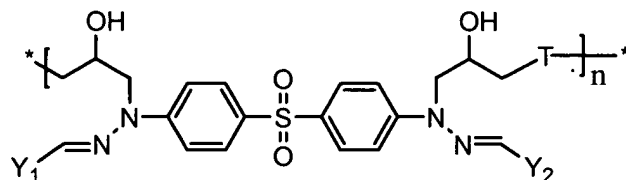
15 (b) a charge generating compound.

2. An organophotoreceptor according to claim 1 wherein Y<sub>1</sub> and Y<sub>2</sub>, each independently, comprise an (N,N-disubstituted)arylamine group, a julolidine group, or a carbazole group.

3. An organophotoreceptor according to claim 1 wherein  $X_1$  and  $X_2$  comprise, each independently, a  $-(CH_2)_m-$  group where  $m$  is an integer between 1 and 30, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, B, Si, P, C=O, O=S=O, a heterocyclic group, an aromatic group, an  $NR_a$  group, a  $CR_b$  group, a  $CR_cR_d$  group, or a  $SiR_eR_f$  where  $R_a$ ,  $R_b$ ,  $R_c$ ,  $R_d$ ,  $R_e$ , and  $R_f$  are, each independently, a bond, H, a hydroxyl group, a thiol group, a carboxyl group, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group.

4. An organophotoreceptor according to claim 3 wherein at least one of the methylene groups is replaced by a heterocyclic group, an aromatic group, a CHOH group, O, or S.

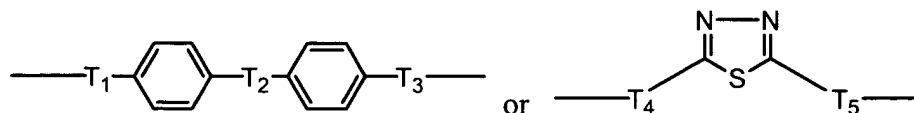
5. An organophotoreceptor according to claim 3 wherein the charge transport composition has the following formula:



where n is a distribution of integers between 1 and 100,000;

Y<sub>1</sub> and Y<sub>2</sub> are, each independently, an arylamine group; and

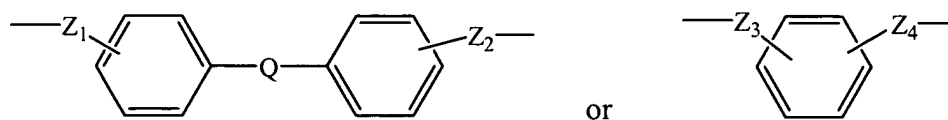
T has one of the following formulae:



where T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, and T<sub>5</sub> are, each independently, O, S, O=S=O, or C=O.

6. An organophotoreceptor according to claim 1 wherein Z comprises a -(CH<sub>2</sub>)<sub>k</sub>- group where k is an integer between 1 and 30, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, B, Si, P, C=O, O=S=O, a heterocyclic group, an aromatic group, an NR<sub>g</sub> group, a CR<sub>h</sub> group, a CR<sub>i</sub>R<sub>j</sub> group, or a SiR<sub>k</sub>R<sub>l</sub> where R<sub>g</sub>, R<sub>h</sub>, R<sub>i</sub>, R<sub>j</sub>, R<sub>k</sub>, and R<sub>l</sub> are, each independently, a bond, H, a hydroxyl group, a thiol group, a carboxyl group, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group.

7. An organophotoreceptor according to claim 6 wherein Z has the formulae:

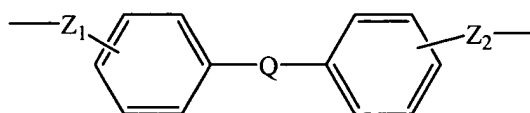


where Q is a bond, O, S, O=S=O, C=O, an aryl group, an NR<sub>3</sub> group, or a CR<sub>4</sub>R<sub>5</sub> group,

where R<sub>3</sub>, R<sub>4</sub>, and R<sub>5</sub> are, each independently, H, an alkyl group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group; and

$Z_1$ ,  $Z_2$ ,  $Z_3$ , and  $Z_4$  are, each independently, a bond or a  $-(CH_2)_n-$  group where  $n$  is an integer between 1 and 20, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, Si, B, P, C=O, O=S=O, a heterocyclic group, an aromatic group, urethane, urea, an ester group, an  $NR_6$  group, a  $CR_7$  group, a  $CR_8R_9$  group, or a  $SiR_{10}R_{11}$  group, where  $R_6$ ,  $R_7$ ,  $R_8$ ,  $R_9$ ,  $R_{10}$ , and  $R_{11}$  are, each independently, a bond, H, hydroxyl, thiol, carboxyl, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group.

8. An organophotoreceptor according to claim 7 wherein Z has the formula:



where Q is O=S=O, and  $Z_1$  and  $Z_2$  are, each independently, a bond.

9. An organophotoreceptor according to claim 1 wherein the photoconductive element further comprises a second charge transport material.

10. An organophotoreceptor according to claim 9 wherein the second charge transport material comprises an electron transport compound.

11. An organophotoreceptor according to claim 1 wherein the photoconductive element further comprises a polymer binder.

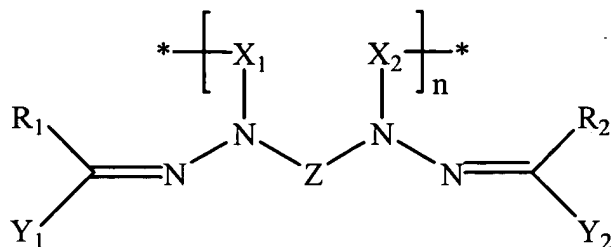
12. An electrophotographic imaging apparatus comprising:

(a) a light imaging component; and

(b) an organophotoreceptor oriented to receive light from the light imaging component,

the organophotoreceptor comprising an electrically conductive substrate and a photoconductive element on the electrically conductive substrate, the photoconductive element comprising:

(i) a charge transport composition having the formula



where Y<sub>1</sub> and Y<sub>2</sub> are, each independently, an arylamine group;

X<sub>1</sub> and X<sub>2</sub> are, each independently, a linking group;

R<sub>1</sub> and R<sub>2</sub> are, each independently, a hydrogen, an alkyl group, an alkenyl group, a

heterocyclic group, an aromatic group;

Z is a bridging group; and

n is a distribution of integers between 1 and 100,000 with an average of greater than 1;

and

(ii) a charge generating compound.

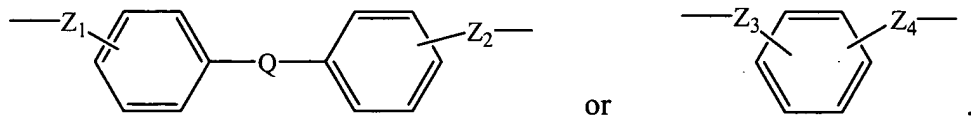
13. An electrophotographic imaging apparatus according to claim 12 wherein Y<sub>1</sub> and Y<sub>2</sub>, each independently, comprise an (N,N-disubstituted)arylamine group, a julolidine group, or a carbazole group.

14. An electrophotographic imaging apparatus according to claim 12 wherein X<sub>1</sub> and X<sub>2</sub> comprise, each independently, a -(CH<sub>2</sub>)<sub>m</sub>- group where m is an integer between 1 and 30, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, B, Si, P, C=O, O=S=O, a heterocyclic group, an aromatic group, an NR<sub>a</sub> group, a CR<sub>b</sub> group, a CR<sub>c</sub>R<sub>d</sub> group, or a SiR<sub>e</sub>R<sub>f</sub> where R<sub>a</sub>, R<sub>b</sub>, R<sub>c</sub>, R<sub>d</sub>, R<sub>e</sub>, and R<sub>f</sub> are, each independently, a bond, H, a hydroxyl group, a thiol group, a carboxyl group, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group.

15. An electrophotographic imaging apparatus according to claim 14 wherein at least one of the methylene groups is replaced by a heterocyclic group, an aromatic group, a CHOH group, O, or S

16. An electrophotographic imaging apparatus according to claim 12 wherein Z comprises a  $-(CH_2)_k-$  group where k is an integer between 1 and 30, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, B, Si, P, C=O, O=S=O, a heterocyclic group, an aromatic group, an  $NR_g$  group, a  $CR_h$  group, a  $CR_iR_j$  group, or a  $SiR_kR_l$  where  $R_g$ ,  $R_h$ ,  $R_i$ ,  $R_j$ ,  $R_k$ , and  $R_l$  are, each independently, a bond, H, a hydroxyl group, a thiol group, a carboxyl group, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group

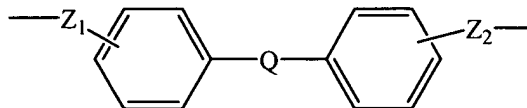
17. An electrophotographic imaging apparatus according to claim 16 wherein Z has the formulae:



where Q is a bond, O, S, O=S=O, C=O, an aryl group, an  $NR_3$  group, or a  $CR_4R_5$  group, where  $R_3$ ,  $R_4$ , and  $R_5$  are, each independently, H, an alkyl group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group; and

$Z_1$ ,  $Z_2$ ,  $Z_3$ , and  $Z_4$  are, each independently, a bond or a  $-(CH_2)_n-$  group where n is an integer between 1 and 20, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, Si, B, P, C=O, O=S=O, a heterocyclic group, an aromatic group, urethane, urea, an ester group, an  $NR_6$  group, a  $CR_7$  group, a  $CR_8R_9$  group, or a  $SiR_{10}R_{11}$  group, where  $R_6$ ,  $R_7$ ,  $R_8$ ,  $R_9$ ,  $R_{10}$ , and  $R_{11}$  are, each independently, a bond, H, hydroxyl, thiol, carboxyl, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group.

18. An electrophotographic imaging apparatus according to claim 17 wherein Z has the formula:



where Q is O=S=O, and  $Z_1$  and  $Z_2$  are, each independently, a bond.

19. An electrophotographic imaging apparatus according to claim 12 wherein the photoconductive element further comprises an electron transport compound.

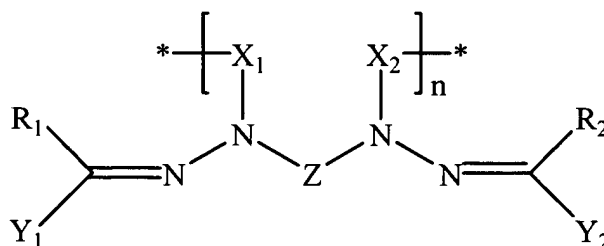
20. An electrophotographic imaging apparatus according to claim 12 wherein the photoconductive element further comprises a binder.

21. An electrophotographic imaging apparatus according to claim 12 further comprising a toner dispenser.

22. An electrophotographic imaging process comprising:

- (a) applying an electrical charge to a surface of an organophotoreceptor comprising an electrically conductive substrate and a photoconductive element on the electrically conductive substrate, the photoconductive element comprising:

- (i) a charge transport composition having the formula



where Y<sub>1</sub> and Y<sub>2</sub> are, each independently, an arylamine group;

$X_1$  and  $X_2$  are, each independently, a linking group;

R<sub>1</sub> and R<sub>2</sub> are, each independently, a hydrogen, an alkyl group, an alkenyl group, a heterocyclic group, an aromatic group;

Z is a bridging group; and

$n$  is a distribution of integers between 1 and 100,000 with an average greater than 1; and

- (ii) a charge generating compound;

- (b) imagewise exposing the surface of the organophotoreceptor to radiation to dissipate charge in selected areas and thereby form a pattern of charged and uncharged areas on the surface;

- (c) contacting the surface with a toner to create a toned image; and

- (d) transferring the toned image to a substrate.

23. An electrophotographic imaging process according to claim 22 wherein  $Y_1$  and  $Y_2$ , each independently, comprise an (N,N-disubstituted)arylamine group, a julolidine group, or a carbazole group.

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24. An electrophotographic imaging process according to claim 22 wherein  $X_1$  and  $X_2$  comprise, each independently, a  $-(CH_2)_m-$  group where  $m$  is an integer between 1 and 30, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, B, Si, P, C=O, O=S=O, a heterocyclic group, an aromatic group, an  $NR_a$  group, a  $CR_b$  group, a  $CR_cR_d$  group, or a  $SiR_eR_f$  where  $R_a$ ,  $R_b$ ,  $R_c$ ,  $R_d$ ,  $R_e$ , and  $R_f$  are, each independently, a bond, H, a hydroxyl group, a thiol group, a carboxyl group, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group.

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25. An electrophotographic imaging process according to claim 22 wherein  $Z$  comprises a  $-(CH_2)_k-$  group where  $k$  is an integer between 1 and 30, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, B, Si, P, C=O, O=S=O, a heterocyclic group, an aromatic group, an  $NR_g$  group, a  $CR_h$  group, a  $CR_iR_j$  group, or a  $SiR_kR_l$  where  $R_g$ ,  $R_h$ ,  $R_i$ ,  $R_j$ ,  $R_k$ , and  $R_l$  are, each independently, a bond, H, a hydroxyl group, a thiol group, a carboxyl group, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group.

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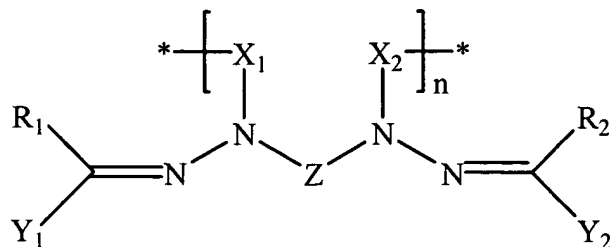
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26. An electrophotographic imaging process according to claim 22 wherein the photoconductive element further comprises an electron transport compound.

27. An electrophotographic imaging process according to claim 20 wherein the toner comprises a toner comprising colorant particles.

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28. A charge transport composition having the formula:



where Y<sub>1</sub> and Y<sub>2</sub> are, each independently, an arylamine group;

X<sub>1</sub> and X<sub>2</sub> are, each independently, a linking group;

R<sub>1</sub> and R<sub>2</sub> are, each independently, a hydrogen, an alkyl group, an alkenyl group, a

heterocyclic group, an aromatic group;

Z is a bridging group; and

n is a distribution of integers between 1 and 100,000 with an average greater than 1.

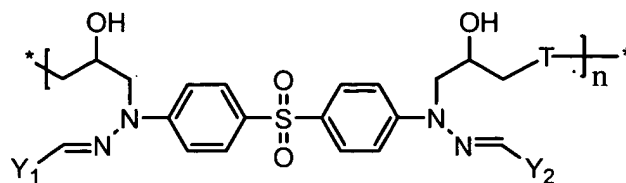
29. A charge transport composition according to claim 28 wherein Y<sub>1</sub> and Y<sub>2</sub>, each independently, comprise an (N,N-disubstituted)arylamine group, a julolidine group, or a carbazole group.

30. A charge transport composition according to claim 28 wherein X<sub>1</sub> and X<sub>2</sub> comprise, each independently, a -(CH<sub>2</sub>)<sub>m</sub>- group where m is an integer between 1 and 30, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, B, Si, P, C=O, O=S=O, a heterocyclic group, an aromatic group, an NR<sub>a</sub> group, a CR<sub>b</sub> group, a CR<sub>c</sub>R<sub>d</sub> group, or a SiR<sub>e</sub>R<sub>f</sub> where R<sub>a</sub>, R<sub>b</sub>, R<sub>c</sub>, R<sub>d</sub>, R<sub>e</sub>, and R<sub>f</sub> are, each independently, a bond, H, a hydroxyl group, a thiol group, a carboxyl group, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group.

31. A charge transport composition according to claim 30 wherein at least one of the methylene groups is replaced by a heterocyclic group, an aromatic group, a CHOH group, O, or S.

32. A charge transport composition according to claim 30 wherein the charge transport composition has the following formula:

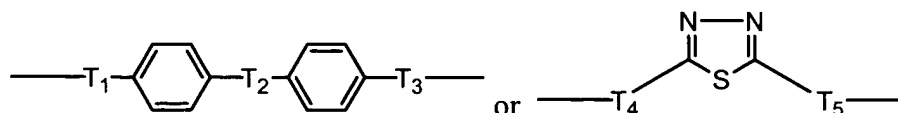




where n is a distribution of integers between 1 and 100,000 with an average value greater than 1;

$Y_1$  and  $Y_2$  are, each independently, an arylamine group; and

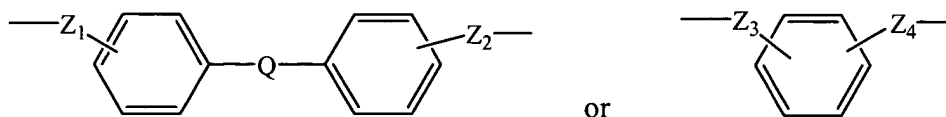
5 T has one of the following formulae:



where  $T_1$ ,  $T_2$ ,  $T_3$ ,  $T_4$ , and  $T_5$  are, each independently, O, S, O=S=O, or C=O.

33. A charge transport composition according to claim 28 wherein Z comprises  
 10 a  $-(CH_2)_k-$  group where k is an integer between 1 and 30, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, B, Si, P, C=O, O=S=O, a heterocyclic group, an aromatic group, an  $NR_g$  group, a  $CR_h$  group, a  $CR_iR_j$  group, or a  $SiR_kR_l$  where  $R_g$ ,  $R_h$ ,  $R_i$ ,  $R_j$ ,  $R_k$ , and  $R_l$  are, each independently, a bond, H, a hydroxyl group, a thiol group, a carboxyl group, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group,  
 15 an aromatic group, or part of a ring group.

34. A charge transport composition according to claim 33 wherein Z has the formulae:

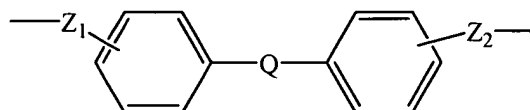


where Q is a bond, O, S, O=S=O, C=O, an aryl group, an  $NR_3$  group, or a  $CR_4R_5$  group,  
 20 where  $R_3$ ,  $R_4$ , and  $R_5$  are, each independently, H, an alkyl group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group; and

$Z_1$ ,  $Z_2$ ,  $Z_3$ , and  $Z_4$  are, each independently, a bond or a  $-(CH_2)_n-$  group where n is an integer between 1 and 20, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, Si, B, P, C=O, O=S=O, a heterocyclic group, an aromatic group,  
 25 urethane, urea, an ester group, an  $NR_6$  group, a  $CR_7$  group, a  $CR_8R_9$  group, or a  $SiR_{10}R_{11}$  group, where  $R_6$ ,  $R_7$ ,  $R_8$ ,  $R_9$ ,  $R_{10}$ , and  $R_{11}$  are, each independently, a bond, H, hydroxyl, thiol, carboxyl,

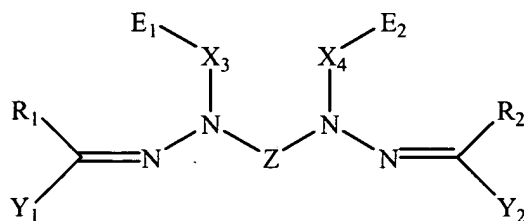
an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group.

35. A charge transport composition according to claim 34 wherein Z has the formulae:



where Q is O=S=O, and Z<sub>1</sub> and Z<sub>2</sub> are, each independently, a bond.

36. A charge transport composition prepared by co-polymerizing a multi-functional compound comprising at least 2 active hydrogens selected from the group consisting of hydroxyl hydrogen, amino hydrogen, carboxyl hydrogen, and thiol hydrogen with a reactive-ring compound having the following formula



where Y<sub>1</sub> and Y<sub>2</sub> are, each independently, an arylamine group;

X<sub>3</sub> and X<sub>4</sub>, each independently, comprise a -(CH<sub>2</sub>)<sub>p</sub>- group, where p is an integer between 1 and 20, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, B, Si, P, C=O, O=S=O, a heterocyclic group, an aromatic group, an NR<sub>m</sub> group, a CR<sub>n</sub> group, a CR<sub>o</sub>R<sub>p</sub> group, or a SiR<sub>q</sub>R<sub>r</sub> where R<sub>m</sub>, R<sub>n</sub>, R<sub>o</sub>, R<sub>p</sub>, R<sub>q</sub>, and R<sub>r</sub> are, each independently, a bond, H, a hydroxyl group, a thiol group, a carboxyl group, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group;

R<sub>1</sub> and R<sub>2</sub> are, each independently, a hydrogen, an alkyl group, an alkenyl group, a heterocyclic group, an aromatic group;

Z comprises a -(CH<sub>2</sub>)<sub>k</sub>- group where k is an integer between 1 and 30, inclusive, and one or more of the methylene groups is optionally replaced by O, S, N, C, B, Si, P, C=O, O=S=O, a heterocyclic group, an aromatic group, an NR<sub>g</sub> group, a CR<sub>h</sub> group, a CR<sub>i</sub>R<sub>j</sub> group, or a SiR<sub>k</sub>R<sub>l</sub> where R<sub>g</sub>, R<sub>h</sub>, R<sub>i</sub>, R<sub>j</sub>, R<sub>k</sub>, and R<sub>l</sub> are, each independently, a bond, H, a hydroxyl group, a thiol group, a carboxyl group, an amino group, an alkyl group, an alkoxy group, an alkenyl group, a heterocyclic group, an aromatic group, or part of a ring group; and

E<sub>1</sub> and E<sub>2</sub> are, each independently, a reactive ring group.

37. A charge transport composition according to claim 36 wherein E<sub>1</sub> and E<sub>2</sub>, each independently, are selected from the group consisting of 3-, 4-, 5-, 7-, 8-, 9-, 10-, 11-, and 12-membered heterocyclic ring groups.

38. A charge transport composition according to claim 36 wherein E<sub>1</sub> and E<sub>2</sub>, each independently, are selected from the group consisting of 3-, 4-, 5-, 7-, 8-, 9-, 10-, 11-, and 12-membered cyclic ethers, cyclic amines, cyclic sulfides, cyclic amides, N-carboxy- $\alpha$ -amino acid anhydrides, lactones, and cyclosiloxanes.

39. A charge transport composition according to claim 36 wherein E<sub>1</sub> and E<sub>2</sub>, each independently, are selected from the group consisting of epoxides, oxetanes, aziridines, thiiranes, 2-azetidinone, 2-pyrrolidone, 2-piperidone, caprolactam, enantholactam, and capryllactam.

40. A charge transport composition according to claim 36 wherein the multi-functional compound is selected from the group consisting of triols, triamines, trithiols, diols, dithiols, diamines, dicarboxylic acids, hydroxylamines, amino acids, hydroxyl acids, thiol acids, hydroxythiosl, and thioamines.